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Short Report

Y-chromosomal STR haplotype diversity in males from Santa Catarina, Brazil

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ABSTRACT

One-hundred and nine unrelated and healthy males from Santa Catarina, Brazil were included in this study. Allele frequencies and gene diversities for the loci DYS456, DYS458 and DYS448 were calculated. A comparison between our population and others was performed.

1. Extraction

DNA was extracted from blood samples using the Chelex® method[1] and purified, if necessary, using a modified organic phenol–chloroform–isoamylalcohol method.[2]

2. PCR

The co-amplification of the 16 Y-STR markers (17 loci), DYS456, DYS389I, DYS390, DYS389II, DYS458, DYS19, DYS385, DYS393, DYS391, DYS439, DYS635, DYS392, GATA H4, DYS437, DYS438 and DYS448 was performed using the AmpFℓSTR® Yfiler™ PCR Amplification Kit (Applied Biosystems). Reactions for multiplex PCR were prepared according to the kit manufacturer's instructions and carried out in a thermocycler GeneAmp® PCR System 9700 (Applied Biosystems).

3. Typing

The amplified products were detected and separated by capillary electrophoresis using an ABI PRISM® 3100 Genetic Analyzer (Applied Biosystems). Allele designations were determined by comparison with allelic ladders included in the kit and the nomenclature was reported following the guidelines of the ISFG recommendations.[3] To follow these guidelines a correction factor of 9 was added to the GATA H4 alleles obtained with the kit.[4]

4. Results

4.1. Analysis of data

Allele frequencies were estimated by direct counting (Table 1); haplotypes (Table 2) and gene diversities (Table 1) were generated and calculated according to Nei[5] using the Arlequin Software package Ver 3.1.[6] In Table 1 we only present the results of the loci DYS456, DYS458 and DYS448 because the others have already been reported previously.[7,8] The genetic analysis of these three Y-STR performed in this study is complementary to the above mentioned studies reported for the Santa Catarina population. Our results were compared with previously published data obtained from historically.[9,10] or geographically related populations.[11–15] To illustrate the relationship between populations a Neighbor-Joining Tree was constructed, using the Phylip version 3.5c software package[16] (Fig. 1). The tree was visualized using the Tree View version 1.6.6 program.[17]

4.2. Other remarks

A total of 103 different haplotypes were detected from the 109 males, 97 of them being unique. As expected, an increased number of different haplotypes were observed with these 16 Y-STR,

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Table 1
Allele frequencies and gene diversity at DYS456, DYS458 and DYS448 in Santa Catarina population sample (N = 109).

Allele	DYS456	DYS458	DYS448
13	0.009	–	–
14	0.101	0.028	–
15	0.440	0.220	–
16	0.303	0.202	–
17	0.128	0.294	0.009
18	0.018	0.147	0.046
19	–	0.073	0.541
20	–	0.037	0.312
21	–	–	0.064
22	–	–	0.018
23	–	–	0.009
Gene diversity	0.6937	0.8029	0.6086

compared with the results obtained from the same individuals using fewer Y-STR.[7,8] The haplotype diversity in the 16 Y-STR markers was 0.9990 ± 0.0014. This value is higher than those found in other studies from the Brazilian population, based on five and eight Y-STR core markers.[11,18] Gene diversity values of these 16 Y-STR ranged from 0.5262 (DYS393)[7] to 0.8962 (DYS385).[7] The Neighbor-Joining Tree constructed from the FST values shows that Santa Catarina and Portuguese populations are in the same cluster. This finding could suggest a Portuguese origin for the Santa Catarina population, explained as a consequence of its colonization. This colonization began in the 16th century with the arrival of the Portuguese. Azorean immigrants came later, in the 18th century, sent by the Portuguese king to complete the process. The potential usefulness of these combined 16 Y-STR for male discrimination purposes has thus been established in the Santa Catarina population.

Table 2
16 Y-STR haplotypes observed in the Santa Catarina population sample (N = 109).

DYS456	DYS389 I	DYS390	DYS389 II	DYS458	DYS19	DYS385	DYS393	DYS391	DYS439	DYS635	DYS392	GATA H4.1	DYS437	DYS438	DYS448	N
15	14	24	30	17	14	10, 13	14	11	12	23	13	21	15	12	19	1
16	13	24	29	16	15	11, 14	13	11	12	23	13	21	15	12	19	1
17	13	23	30	17	16	12, 17	13	11	12	22	11	20	15	10	20	1
15	13	24	29	18	14	11, 14	14	11	12	23	13	21	15	12	19	1
16	12	24	26	16	15	12, 14	14	11	10	24	13	20	15	12	20	1
15	13	20	29	17	14	11, 14	13	11	13	23	13	21	15	12	19	1
15	13	25	31	15	15	11, 15	13	11	10	23	11	22	14	11	20	1
15	13	25	29	17	14	11, 14	13	10	12	23	13	20	15	12	19	1
17	14	23	31	19	14	13, 14	12	10	12	22	11	20	14	9	21	1
16	13	24	29	18	14	11, 14	13	11	12	23	13	21	15	12	19	2
16	13	23	29	18	14	11, 14	13	11	12	23	12	19	15	12	19	1
15	13	23	30	17	14	10, 14	12	11	12	23	13	20	15	12	19	1
15	12	24	27	17	14	11, 14	13	11	13	23	13	21	15	12	19	1
14	12	25	28	16	15	13, 16	12	10	11	21	11	20	14	10	19	1
16	13	23	29	14	15	12, 15	12	9	12	21	11	21	14	9	21	1
14	12	23	28	16	14	13, 14	13	10	12	23	11	21	16	10	20	1
16	13	25	29	17	14	11, 11	14	10	12	24	13	21	15	12	18	1
15	13	24	29	16	14	10, 13	13	11	13	23	13	21	15	10	19	1
14	13	23	29	15	15	13, 14	14	10	11	21	12	19	14	10	20	1
15	13	24	29	18	14	11, 14	15	11	12	23	12	21	14	12	19	1
15	13	26	29	18	14	10, 13	13	11	12	23	13	21	15	12	19	1
16	13	24	29	18	14	11, 13	13	10	12	23	13	20	15	12	19	1
14	14	22	31	17	15	13, 14	14	10	11	20	11	20	16	10	20	1
15	13	24	31	18	14	8, 11	13	11	12	23	13	21	15	12	19	1
15	13	23	29	17	15	10, 12	13	11	11	23	13	21	15	12	19	1
15	13	20	29	17	14	10, 13	13	11	13	23	13	21	16	12	19	2
15	13	23	29	15	14	10, 13	14	11	12	23	13	22	15	12	19	1
15	13	23	30	18	14	10, 14	13	11	13	26	13	20	16	12	19	1
15	12	23	28	15	14	12, 14	13	10	11	20	11	20	16	10	20	1
17	11	24	26	17	14	10 13	13	11	13	24	13	21	15	12	19	1
15	13	23	29	16	14	12, 15	12	10	12	21	11	22	14	9	20	1
16	13	24	30	15	14	10, 13	12	10	15	23	13	20	15	12	20	1
16	13	23	31	15	15	14, 16	14	10	11	22	11	20	14	11	20	2
17	11	24	28	19	14	10, 13	13	11	12	20	13	21	15	12	19	1
17	12	24	28	19	14	10, 13	13	11	12	20	13	21	15	12	19	1
15	12	24	29	17	15	11, 14	13	11	12	23	13	21	15	12	19	1
16	14	21	31	15	16	16, 17	15	10	12	21	11	20	14	11	20	1
15	14	25	31	17	14	10, 13	11	10	13	23	13	20	15	12	19	1
17	13	24	29	17	14	10, 14	14	11	12	23	13	20	14	9	18	1
16	13	25	29	15	14	10, 13	13	10	11	23	13	21	15	13	18	1
15	13	24	30	18	16	10, 13	13	11	12	23	13	21	15	12	19	1
16	13	24	29	14	14	10, 13	13	11	12	23	13	21	15	12	19	1
15	13	22	29	20	15	11, 18	13	10	11	21	11	19	14	10	20	2
15	14	23	30	16	14	10, 10	13	11	12	23	13	21	15	12	19	1
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16	13	24	29	18	14	11, 14	13	11	11	23	13	21	15	12	19	1
14	14	23	30	17	12	11, 13	13	10	10	22	14	21	14	10	19	1
15	12	23	30	19	13	12, 18	12	10	12	21	11	19	14	10	20	1

(*continued on next page*)

Table 2 (*continued*)

DYS456	DYS389 I	DYS390	DYS389 II	DYS458	DYS19	DYS385	DYS393	DYS391	DYS439	DYS635	DYS392	GATA H4.1	DYS437	DYS438	DYS448	*N*
16	13	25	29	17	14	11, 15	13	13	12	23	10	21	14	10	19	1
16	14	22	30	16	13	12, 15	13	13	11	22	10	21	15	9	19	1
15	12	23	28	15	14	13, 14	13	10	11	21	11	20	16	10	20	2
15	12	25	29	15	15	11, 14	13	11	11	21	11	19	14	10	19	2
18	12	22	29	16	15	14, 14	14	11	13	21	11	21	16	10	21	1
15	14	24	29	19	14	12, 13	12	11	12	24	13	22	15	12	19	1
16	12	24	28	16	14	12, 15	13	10	12	23	13	21	14	12	18	1
16	13	24	30	16	15	12, 16	13	11	11	21	11	20	14	10	19	1
16	13	24	30	16	15	11, 16	13	11	11	23	11	20	14	10	19	1
17	12	24	28	17	14	10, 13	13	11	12	23	13	21	15	12	19	1
15	13	24	29	17	15	10, 13	13	11	12	23	13	21	15	12	19	1
16	13	25	29	17	15	9, 13	13	11	11	23	11	20	14	11	20	1
15	13	24	29	15	13	14, 17	13	10	12	21	11	21	14	10	20	1
15	12	21	28	15	16	14, 15	14	11	11	23	11	20	16	10	22	1
16	13	24	29	19	15	10, 13	13	10	12	23	13	21	15	12	19	1
16	13	24	29	18	13	10, 13	13	10	12	23	13	20	14	12	20	1
15	13	24	29	17	14	10, 13	13	11	13	23	13	21	15	12	19	1
14	12	23	25	15	14	12, 13	13	10	11	21	11	21	16	10	20	1
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16	13	24	29	16	14	11, 12	13	10	12	23	13	21	15	12	19	1
15	13	23	30	16	13	11, 16	13	9	12	21	11	21	14	10	20	1
16	13	24	28	17	15	10, 13	13	10	12	23	13	21	14	10	17	1
16	13	24	29	17	14	10, 12	14	11	12	23	13	21	15	12	19	1
16	13	24	29	17	14	10, 13	12	10	13	23	13	20	15	12	19	1
14	13	23	29	16	16	15, 18	15	10	11	22	12	20	14	10	19	1
17	13	24	29	16	14	10, 13	13	12	12	23	13	21	15	12	19	1
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14	14	23	32	17	15	14, 15	16	10	11	20	12	20	15	10	20	1
13	13	24	31	15	15	18, 19	13	10	11	20	11	21	14	10	20	1
15	13	23	29	14	15	12, 16	12	11	11	21	13	21	14	9	21	1
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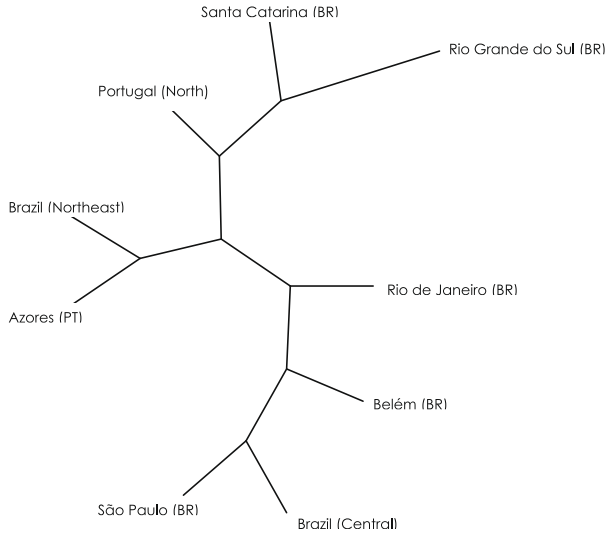

Fig. 1. Neighbor-Joining Tree based on 7 Y-STR from Portuguese and Brazilian populations.

The complete data set is available upon request at lcaine@dpinml.mj.pt.

Conflict of Interest

None declared.

Funding

None declared.

Ethical Approval

None declared.

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